



# Integrated Safety Management (ISM)

ISM  
06/09/2003

From the Directorate:

**"Do work safely."**

- Fermilab policy:
  - Fermilab employees and users will only conduct work and operations in a safe and environmentally sound manner.



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## Priorities

1 You

2 Others if you do not put yourself at risk

3 The environment if you do not put  
people at risk

4 The experiment if you do not put  
people or the environment at risk


When in doubt, **dial 3131**



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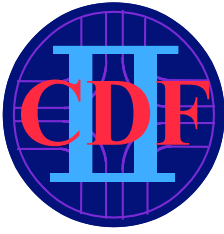
## ● Principles:

- Line management responsible for safety 
- Clear roles and responsibilities
- Competence commensurate with responsibilities
- Balances priorities
- Identification of safety standards and requirements
- Hazard Controls tailored to work
- Operations authorization

## ● Core functions:

- Define work
- Analyze hazards
- Establish controls
- Perform work
- Provide feedback and improvements

ES&H Dept.  
Safety Committees  
Work Permits (WPs)  
Job Hazard Analyses (JHAs)  
Operational Readiness  
Clearances (ORCs, pORCs)

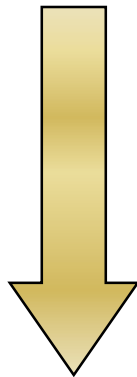


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## ● PPD Implementation of ISM

- CDF is in Particle Physics Division of Fermilab (PPD), though we must also worry about Accelerator Division (AD) restrictions since collision hall is part of Tevatron
- “...more eyes on the hazards and mitigation of the hazards are needed to find and avoid the more exotic problems.”



PPD Implementation  
of  
Integrated Safety Management (ISM)  
and  
Fermilab ES&H Manual (FESHM) Chapter 2060

PPD\_OPER\_004

### I. Introduction

This document describes the PPD Implementation of ISM and FESHM 2060.

Within PPD our focus is work planning. A hazard analysis and mitigation of the hazards is a natural part of this planning. Approval of the work and notification of supervisors about work plans is the standard procedure, and review of completed work to improve future work should be a part of our standard practice. Throughout the rest of this document, the term “**Work Plan/Hazard Analysis**” will be used to summarize this process.

This implementation is not intended to challenge the competence of trained and experienced people. We are working towards safety performance at a new level where more eyes on the hazards and mitigation of the hazards are needed to find and avoid the more exotic problems. We also need to be alert for accident situations stemming from several ordinary hazards working in concert. “More eyes” includes writing Work Plan/Hazard Analysis, having the written plan reviewed by experts in some cases, having every individual on a work team read and sign the written plan, and having the approved written plan distributed to the next level in line management.

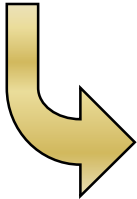
This implementation is intended to follow FESHM 2060. Instead of references to FESHM chapters or to CFR (Code of Federal Regulations), this PPD document attempts to collect the full set of FESHM 2060 guidance and other special PPD concerns in terms of simple phrases for easy everyday reference.



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“Line management Responsibility for Safety” includes everyone in the division.



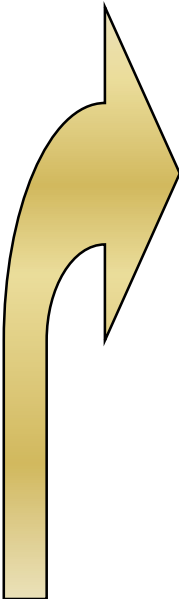
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## III. Responsibilities of Individuals

- ◆ "Line Management Responsibility for Safety" includes everyone in the division. We are all part of the "line". It is expected that individuals will follow the ISM core functions for every task. These functions are:

- Define the work
- Analyze the hazards associated with the task(s)
- Take action to mitigate those hazards
- Perform the work within the hazard controls
- Provide feedback to allow improvements

In your daily work, you should use these five core functions as your work guide.



- ◆ PPD requires a written Work Plan/Hazard Analysis if:

- Your task involves two or more of the hazards in Table 1.

Note: your judgement is required. For example, PPD does not expect a full written hazard analysis if you are working on a ladder 6 feet above the floor and there is an electrical outlet nearby (this is not an electrical hazard). PPD does expect a full written hazard analysis if you are modifying a pressurized system from a ladder position 6 feet above the floor.

If there are two hazards due to faulty equipment, e.g. a frayed electrical cord, PPD expects you to fix the hazard before beginning the task. Do not write a hazard analysis.

Contact your supervisor for help if you have questions.

- Your task involves one of the PPD High Level hazards in Table 1.

Note: your judgement is required. PPD expects you to be on alert for all hazards. PPD does not expect you to consider every potential hazard as a "high hazard". Contact your supervisor for help if you have questions.

- ◆ You should work with your supervisor to develop a written Work Plans/Hazard Analysis when required. Usually a team of individuals and a supervisor will collaborate to write the document.

- ◆ You should read and sign the Work Plan/Hazard Analysis before performing the task.

➤ PPD requires a written Work Plan/Hazard Analysis if:

- Your task involves two or more of the hazards in Table 1.
- Your task involves one of the PPD High Level hazards in Table 1.



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Table 1. List of Hazards and thresholds indicating "high-level" hazards faced by individuals in PPD.

<b>Hazard</b> (If your task has TWO hazards, write a Work Plan/Hazard Analysis)	<b>PPD "High-Level" Hazards</b> (If your task has ONE high-level hazard, write a Work Plan/Hazard Analysis)
<b>Radiation</b> Radiation areas at Fermilab are labeled --work in a <u>Controlled Area</u> or in a <u>Radiation Area</u> is a hazard. However, work in a Controlled Area by people already specifically trained for the radiation hazards in that area is NOT a hazard. Known radioactive objects at Fermilab are labeled with a "Class" sticker -- work on such objects is a hazard. Work with radioactive sources is a hazard.	Work in a <u>High Radiation Area</u> . Work on Class 2-5 radioactive objects. Work with contaminated objects. Work with radioactive liquids. Work with depleted Uranium. Moving sources between buildings.
<b>Electrical Work</b> Hazards are electrocution and injuries associated with arc blast (burns, hearing loss, flying debris).	Work activities near or on exposed electrical conductors, circuits, or equipment that are or may be energized and where there is a <u>significant potential</u> for arcing, flash burns, electrical burns, or arc blast. Any work on an AC electrical power distribution system.
<b>Electronics Work</b> A hazard if a worker is likely to be exposed to voltages, currents, or stored electrical energy of sufficient magnitude and duration to startle or injure if shocking, arcing, sparking, or heating should occur. Workers must have Basic Electrical Safety training.	Work activities near or on exposed electrical conductors, circuits, or equipment that are or may be energized and where there is a <u>significant potential</u> for arcing, flash burns, electrical burns, or arc blast. Any work with non-commercial electronics or with electronics modified at Fermilab has a greater hazard potential, particularly in the prototype stage.
<b>Confined Space Work</b> Work in a space that: <ol style="list-style-type: none"> <li>1. Is large enough and so configured that you can bodily enter <u>and</u> perform assigned work; <u>and</u></li> <li>2. Has limited or restricted means for entry or exit; <u>and</u></li> <li>3. Is not designed for continuous occupancy.</li> </ol>	Entry into a "Permit Required Confined Space" -- these are labeled and indicate a potential hazardous atmosphere or other safety hazard in the confined space.
<b>Fall Hazard</b> Work from a ladder at 6 feet or more above the floor. Work from a scissor lift. Work on low slope roofs (less than 4" rise in 12" horizontal).  For clarification, work from previously approved scaffolding is NOT a hazard.	Work from a ladder if 3 of 4 limbs cannot maintain contact with the ladder. Work from a ladder set on uneven or slippery ground. Work from an articulating lift device (e.g. a "cherry picker" or other such single arm device). Work at 6 feet above floor without guardrails. Work on high slope roofs. Any new use of scaffolding, including erection of the scaffolding.
<b>Mechanical Hazards</b> Potential for release of stored energy through falling, rotating, or other unplanned movement.  Note that standard moves of objects with Crane, Hoists, and Forklifts are covered below.	Work with a mechanical system that has the potential to release stored energy in excess of 60,000 foot-pounds. Examples are: 30 tons at 1 foot off the floor, 3 tons at 10 feet off the floor. Any unusual arrangement of heavy objects, even if below 60,000 ft.-lb. energy. Other mechanical stored energy hazards (e.g. springs) require calculation.
<b>Moving Mechanical Hazards</b> Potential for injury from computer controlled moving objects.	Work in an area where an employee can be caught between objects. Work near unguarded rotating shafts.
<b>Hazards in "first time use" of new equipment</b> Potential hazard with any first time use of mechanical or electrical equipment if a <u>significant injury</u> could occur.	First time production work with new equipment designed or modified at Fermilab if a <u>significant injury</u> potential exists. Examples: start of production with a large new mechanical machine is a high hazard, but starting use of a small low-power printed circuit board is not.
<b>Crane, Hoist &amp; Forklift Usage</b> Material handling with this equipment can have a significant potential for injury if done improperly. Below-the-hook lifting devices must be approved fixtures. Employees must be trained and qualified to operate the device.	If exceptional care is required due to size, shape, or close installation tolerance of a particular load. For clarification, it is not usually a high hazard to perform a "standard lift", e.g. a lift within the crane weight limit of a standard shield block using the lift eye or to lift other loads with an approved lifting fixture.
<b>Hydraulic System Hazards</b> These systems can run at several thousand pounds per square inch, so small leaks can be a hazard without eye protection.	Any work where a sudden uncontrolled release (failure) of pressure could result in injury (e.g. people working around a heavy object supported hydraulically could get "caught between"). Work with modified hydraulic systems.
<b>Excavation and Digging</b> Any digging or soil boring with motorized equipment. Any digging (even by hand) where utilities or unsanitary conditions may be encountered. Any digging where on-lookers are present and could be injured.	Digging deeper than 4 feet. Digging into a radiation shield berm. Any excavation that could become a confined space -- for example within or under a building.
<b>Flammable Gas Hazard</b> Flammable gas areas are classified by fire risk and must be reviewed to determine the risk class (unreviewed areas are Class 2). Work in a Risk Class 0 area (risk of small local flash fire) is a hazard.	Work in a Flammable Gas Risk Class 1 Area (risk of local fire) or in a Risk Class 2 Area (risk of a general fire).





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Table 1 continues.

<b>Hazard</b> (If your task has TWO hazards, write a Work Plan/Hazard Analysis)	<b>PPD "High-Level" Hazards</b> (If your task has ONE high-level hazard, write a Work Plan/Hazard Analysis)
<b>Cryogenic Hazards</b> Working with solids, liquids, or gases colder than -150 C.	Working with more than 200 liters of cryogenic material.
<b>Oxygen Deficiency Hazard (ODH)</b> Working in areas that can have large releases of gases to reduce the oxygen concentration below 19.5%. Work in an ODH-1 area is a hazard.	Working in an area classified as <u>ODH-2 or above</u> is a high hazard.
<b>Chemicals</b> Use of materials that are flammable, combustible, corrosive, reactive, toxic, caustic, or poisonous.  Use of any material that because of the quantity and/or manner it is being used is hazardous to the health of the worker.  MSDS are always required and every employee must have HazCom training in how to read an MSDS.  Containers must always be properly labeled.	Work with solvents, reactive or corrosive chemicals in large amounts or in a poorly ventilated area. Work with poisonous chemicals (e.g. plating solutions containing cyanide). Work with highly reactive chemicals (e.g. battery acids, metal cleaning solutions containing a high % of hydrofluoric acid). Work with known carcinogens or cancer-suspect agents (e.g. benzene or methylene chloride or chloroform). Any work with explosive chemicals. Any work with new chemicals synthesized at Fermilab.  Occasional use of small amounts (500 ml) of consumer products or other chemicals available from the stockroom is not a high hazard.
<b>Hazardous Substances</b> Chemical Carcinogens, Lead, Asbestos, Beryllium and Beryllium Alloys are hazards to workers.	Direct handling of Lead, Asbestos, Beryllium (even when passivated), and Beryllium alloys is always considered a high hazard, but packaged or encapsulated objects are low hazards. Work with known carcinogens or cancer-suspect agents. Clean-up (abatement) work is always a high hazard.
<b>Work with Regulated Pollutants</b> Work that will generate a WASTE product with a chemical that has a flash point below 140 degrees F, a pH below 2, a pH greater than 12.5, or which contains any toxic substance (see MSDS).	Any work that will generate <u>more than 5 gallons</u> of regulated waste. Any work with chemicals where a significant spill is possible and likely to get into the environment (e.g. drain or ditch nearby). The "significant" level will depend on the chemical. Work that will generate a mixed (radioactive + regulated) waste.
<b>Machining and Grinding</b> Moving machinery operated without appropriate guards. Work with the employee in an unusual or awkward position (e.g. overhead grinding is an eye hazard). Sparks from these operations must be controlled.	Machining or grinding hazardous materials such as lead, magnesium, beryllium Removal of structural welds on large weldments (fall hazard may result).
<b>Repetitive Task Hazards</b> Work at an inappropriately designed computer setup. Assembly work with repetitive tasks.	Four consecutive hours of repetitive assembly work. Jobs that may aggravate a pre-existing medical condition. Assembly jobs that have caused previous repetitive injuries.
<b>Noise Hazards</b> Eight hours of work in an environment where you must raise your voice (but not shout) to be heard.	Two hours of work per day in an environment where it is necessary to shout in order to be heard. Work that exceeds a posted noise hazard limitation. (Typically 8 hrs @ 85 dBA).
<b>Other Work Environment Hazards</b> Respiratory hazards from dust, animal waste, ... Work in areas of excessive heat or cold. Work from awkward positions.	Continuous work in temperatures above 86 degrees F or below -25 degrees F must be evaluated.
<b>Magnetic Field Hazards</b> Iron objects in a magnetic field can move.  Cardiac pacemakers, metallic implants, and other medical devices can function improperly in magnetic fields as low as 2.5 gauss.	Work near any area with a fringe field of more than 1 kilogauss in air over an accessible region more than 1 foot long in all directions. Any time averaged exposure of people to 300 gauss or more. Any situation where ferrous objects can be subject to magnetic forces causing sudden unexpected movement.
<b>Lasers</b> Laser systems can present electrical, chemical, and eye or skin hazards from intense visible light. Lasers are classified on a scale of 1 (safe) to 4 (dangerous).	Work with a Class 3b or higher laser (training is required).
<b>Work with Pressure / Vacuum Systems</b> Potential for rupture or implosion. Modification of a pressure system is a hazard. Unusual or rare operation of a pressure or vacuum system is a hazard.	Work on systems with a pressure greater than 150 psi. Work with a vacuum chamber larger than 35 cubic feet and larger than 12 inches in diameter. Work with thin vacuum windows greater than 12 inches in diameter.
<b>Welding, flame cutting, brazing, open flame work</b> Hazards are fire, eye injury, thermal and ultra violet burns, noise, ventilation, toxic fumes. Welding work in an area where passers-by can see the arc.	Any flame cutting on an existing structure.
<b>Work in spaces controlled by other Divisions</b> Potential for unknown hazards.	Always considered a high hazard until analyzed. This includes all Collision Halls.



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You are required to have Work Plans/Hazard Analyses reviewed if the work passes any of the thresholds in Table 2.

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## IV. Responsibilities of Supervisors and Group Leaders

- ◆ The term "Supervisor" or "Group Leader" within PPD includes Detector Project Managers at all WBS levels and Task Managers of T&M activities. As a supervisor of other employees, you have a special responsibility for safety of those employees. **When you assign work to employees, you are responsible for ensuring that Work Plans/Hazard Analyses are written as required by this document.**
- ◆ **You are required** to have a written Work Plan/Job Hazard Analysis for tasks done by your employees if their work passes any of the following thresholds:
  - The task involves two or more of the hazards in Table 1.
  - The task involves one hazard at the "high level" defined in Table 1.
  - The task involves at least one hazard from Table 1 with a work crew where individual responsibilities of each crew member should be clearly spelled out.
  - The task is outside of the normal duties and responsibilities for your group and involves one or more hazards from Table 1.  
(e.g., your group is called to a new area to "help out", or your group is assigned a new permanent and continuing task)
  - The task involves complex activities of more than one day duration and at least one hazard from Table 1.  
(You should consider having daily toolbox meetings to review the complexities each day. But this is not required if a simple task is just being repeated every day.)
  - **If in your judgement the task is complicated and would be done more safely using a written Work Plan/Hazard analysis, then write one!**
- ◆ **For tasks that recur often**, it is permissible to write a generic Work Plan /Hazard Analysis good for one calendar year. All such generic plans expire on December 31 every year and must be reviewed, amended as needed, and re-approved following the instructions below.
- ◆ **You are required to have Work Plans/Hazard Analyses reviewed if the work passes any of the thresholds in Table 2.**

Table 2 indicates who should do the review, either a designated PPD Approver, a PPD Department Head, a PPD ES&H Review Committee, or the Division Head. If an obvious reviewer cannot be identified, contact the Division Office.
- ◆ **If the work is below the thresholds in Table 2, no further approval is required.**
- ◆ Once you have a written plan, you have the following additional responsibilities:
  - Discuss the work plan with all involved employees, and get each employee to sign the Work Plan/Hazard Analysis as a record that the job was understood. Post a copy near the work area if possible.
  - Keep the Work Plan/Hazard Analysis for your employees on file for one year.
  - Provide a copy of the Work Plan/Hazard Analysis up the line in the PPD Line Management as detailed in the PPD Organization chart.  
See Table 2 for additional guidance. Supervisors provide copies to Group Leaders, and Group Leaders provide copies to Department Heads. If you have both a department head (e.g. Support Services) and a project leader (e.g. CMS Project), provide a copy to both.





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Table 2. Hazard vs. Review Matrix.

Hazard	Designated PPD Approver threshold (Who Approves)	Department Head	ES&H Review for use as part of an Experiment	PPD ES&H Department	Division Head
Radiation	Work in a High Radiation Area, or on Class 2-5 objects, or with contaminated objects, radioactive liquids, or depleted Uranium requires a permit. (PPD Radiation Safety Officer)	Notify	Any sources or rad. materials used, sources embedded in detectors	Notify Notify before moving a source to another building.	Notify -----
Electrical Work	Work on AC electrical power distribution system requires an Electrical Work Permit. (Electrical Coordinators)	Notify			Notify Must approve all hot work.
Electronics Work	If "significant potential" for arcing, flash burns, electrical burns, or arc blast. (Immediate Supervisors)	Notify	Systems with non-commercial or modified equipment. Any large capacitor banks.		
Confined Space Work				If known hazards require a Confined Space Permit	Notify
Fall Hazard	Any new scaffolding erection. (PPD Scaffold Competent Person)	Notify		Notify	
Mechanical Hazards	Work with a mechanical system that has the potential to release stored energy in excess of 60,000 foot-pounds. (PPD Engineering Approver)	Notify	over 3 tons supported above floor over 10 tons		Always notify. Must approve if potential energy release is above 500,000 ft-lbs.
Moving Mechanical Hazards	Work with unguarded rotating machinery. (PPD Engineering Approver)	Notify	Moves faster than 5 feet per second	Notify	
Hazards in "first time use" of new equipment	Machines designed or modified for use at Fermilab require an approved procedure before production use. (PPD Engineering Approver)	Notify			Notify
Crane, Hoist & Forklift Usage	Below-the-hook lifting devices require review. (PPD Engineering Approver)			Notify	Approves unusual use (e.g. outside rated load limit)
Hydraulic System Hazards	Fermilab designed or modified systems require review. (PPD Engineering Approver)	Notify			
Excavation and Digging	Excavation permit for any earth removal. (Task Manager or Construction Coordinator)	-----		Notify Permit for any Berm alteration.	----- Notify
Flammable Gas Hazard		Approves work in Flammable Gas Class 1 or 2 areas.	Any use of flammable gas or mixtures	Notify	Approves all Flammable Gas installations
Cryogenic Hazards	Any work with more than 200 liters of cryogenic material. (PPD Engineering Approver)		Any system with inventory exceeding 200 liters		Approves operation of any system with inventory exceeding 200 liters
Oxygen Deficiency Hazard	Work in ODH-1 areas. (Immediate Supervisors)	Approves work in any area classified as ODH-2 or higher	Any use of oxygen displacing gases	Notify for ODH-2 work.	



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Table 2 continues.

Hazard	Designated PPD Approver threshold (Who Approves)	Department Head	ES&H Review for use as part of an Experiment	PPD ES&H Department	Division Head
Chemicals	Work with solvents, reactive or corrosive chemicals in large amounts or in a poorly ventilated area.  (Immediate Supervisors)	Notify		Any work with poisonous, highly reactive, explosive, or carcinogenic chemicals. Any work with new chemicals synthesized at Fermilab.	Notify
Hazardous Substances		Approves direct handling written procedure in advance of work	Any toxic / hazardous materials planned or used	Approves all abatement work.	Notify for Direct Handling & Abatement.
Regulated Pollutants	Any work that will generate greater than 5 gallons of hazardous waste. Any work where a significant spill is possible and likely to get into the environment. (PPD Environmental Protection Officer)	Notify		Notify	
Machining and Grinding				Approves any work with hazardous materials.	Notify for work with hazardous materials.
Repetitive Task Hazards	All repetitive assembly work taking more than 4 hours per day. (Immediate Supervisor)	Notify		Notify	
Noise Hazards				Approves if more than 8 hrs work in an area above 85 dbA.	Notify
Work Environment Hazards	Continuous work in temperatures above 86 degrees F or below -25 degrees F. (Immediate Supervisor)	Notify			
Magnetic Field Hazards	Fringe fields over 1 kilogauss in air extending over 1 cubic foot. Potential mechanical movements due to magnetic fields. (PPD Engineering Approver)	Notify		Any time average exposure of people to 300 or more Gauss	
Lasers	Any work with a Class 3b or higher laser. (Laser Safety Officer in ES&H)	Notify	Any use of any class	Notify	Notify
Work with Pressure / Vacuum Systems	All pressure vessels and vacuum vessels require an engineering review.  (PPD Engineering Approver)	Notify	Review of all vessels	Notify	Following test, approves operation of all pressurized systems > 200 SCFH and all vacuum systems > 35 cubic feet
Welding, flame cutting, brazing, open flame work	All work requires a Burn Permit. (Fermilab Fire Department for permit, PPD Senior Safety Officer for work plan approval)				
Work in space controlled by another division		Notify			Approves all such work.



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- So, where do I find the PPD implementation of ISM?

